Washington State Agency Greenhouse Gas Calculator

Contents and Notes

Agency:	WDOC
Year:	2010

COMMENTS:

Comments on 1-General Agency Information	
Comments on 2 - Building Energy Use	Facility owned spaced data achieved through consumption information. Data on leased space achieved from cost data. 456,489 sqft multiplied by .588 therms/sqft multiplied by 1.1 to account for percentage of space where utility not included in lease. Based on $1.12 /therm and .6/ kwh
Comments on 3 - Fleet Energy Use	This includes fuel data forcorrectioanl industries representing their buisness activities as well as DOC offender transport buses. Consumption data from bulk tanks, Comdata and DOT.
Comments on 4 - Business Travel and Employee Commuting	POV mileage data calculated from cost data by taking the total dollars spent and dividing it by the travel reimbursement rate given for that year. 2009/55 cents per mile. Air travel and employee commuting information unavailable
Comments on 6 - Energy Use By Facility	

Washington State Agency Greenhouse Gas Calculator
General Agency Information Worksheet #1

Agency	WDOC
Calendar Year	2010
Project Lead	Julie Vanneste
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Total # of FTEs	
Total # of Employees	7,918.0
Total # of Students, Patients, etc. (if applicable)	47,439.0

Agency Owned Space (Sq. Ft.)	8,699,235
Space leased in a GA owned building (Sq. Ft.)	121,743
Space leased from another state agency (Sq. ft.)	
Space leased in a privately owned building (Sq. ft.)	469,633 total 348,773 utilites paid by DOC
Total Space (Sq. Ft)	8,820,978

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Building Energy Use Worksheet #2

Agency: WDOC

CY: 2010

required	optional	non-entry

Instructions:

Step 1: Enter the total annual fuel used by your agency in table 1 below in the units specified. Report energy use for all space owned by your agency, space leased from another state agency where you receive a utility bill (do not include space leased from GA), and for all privately leased space. GA will report energy use for the capitol campus and for all GA-owned buildings. If you lease from another state agency, that agency will report energy use for your space unless you receive a utility bill with your actual energy consumption.

Step 2: If you cannot get your energy use information from a utility bill for some or all of your facilities, estimate the energy use based on square footage and the type of space. Use table 2 below to enter your square footage by space type. The tables will calculate your estimated kwh and/or therms. Enter this total into table 1.

Step 3: If you do not have your utiility bills or square footage, estimate energy use by dividing total purchases of electricity or natural gas by the prices provided in table 3 to get the kwh and/or therms. Add the total estimated kwh and therms to table 1 in the yellow highlighted cells to calculate GHG emissions.

Table 1: Total Annual Energy Use in Buildings and Fixed Equipment and GHGs		Agency Owned Space	Privately Leased Space	Total	GHG Emissions				
Emissions Source	Fuel	Fuel Use	Fuel Use	Total	Total Emissions MT CO2e	Fossil MT CO2 (CO2e)	MT CH4 (CO2e)	MT N2O (CO2e)	Biomass MT CO2 (MT CO2e)
STATIONARY COMBUSTION	Natural Gas (Therms)	7,492,137		7,492,136.9	39,946.5	39,723.3	14.2	209.0	0.0
	Fuel Oil (Gallons)	387,128		387,128.0	3,959.2	3,952.6	1.6	5.0	0.0
	Propane (Gallons)	455,209		455,208.8	2,561.9	2,544.6	9.6	7.7	0.0
	Wood (short tons)	0		0.0	0.0	0.0	0.0	0.0	0.0
	Diesel (gallons) (used in fixed generators)			0.0	0.0	0.0	0.0	0.0	0.0
	Biodiesel (100%, gallons) (Used in fixed generators)			0.0	0.0	0.0	0.0	0.0	0.0
	Gasoline (gallons) (used in fixed generators)			0.0	0.0	0.0	0.0	0.0	0.0
	Ethanol (100%, gallons) (Used in fixed generators)			0.0	0.0	0.0	0.0	0.0	0.0
	Aviation Gasoline (gallons) (Used in fixed equipment)			0.0	0.0	0.0	0.0	0.0	0.0
	Jet fuel (gallons) (Used in fixed equipment)			0.0	0.0	0.0	0.0	0.0	0.0
				Total GHG:	46,467.6	46,220.5	25.3	221.8	0.0
PURCHASED ENERGY	Electricity Use (kWh)	124,032,127	6,033,773	130,065,899.9	50,995.5	50,725.7	20.2	249.6	0.0
	Purchased Steam (Million lbs - Mlbs)			0.0	0.0	0.0	0.0	0.0	0.0
				Total GHG:	50,995.5	50,725.7	20.2	249.6	0.0

Table 2: Estimated Electricity and Natural Gas Use						
Use Type	Estimated Electricity Use			Estimated Natural Gas Use		
	Sq. Ft.	kWh/ft^2	kWh	Sq. Ft.	therms/ft^2	therms
Education		11.0	0.0		0.380	0.0
Food Sales		49.4	0.0		0.517	0.0
Food Service		38.4	0.0		1.454	0.0
Health Care		22.9	0.0		0.953	0.0
Inpatient		27.5	0.0		1.131	0.0
Outpatient		16.1	0.0		0.517	0.0
Lodging		13.5	0.0		0.504	0.0
Retail		14.3	0.0		0.318	0.0
Office	348,773	17.3	6,033,772.9		0.328	0.0
Public Assembly		12.5	0.0		0.375	0.0
Public Order and Safety		15.3	0.0		0.450	0.0
Religious Worship		4.9	0.0		0.312	0.0
Service		11.0	0.0		0.557	0.0
Warehouse and storage		7.6	0.0		0.241	0.0
Other		22.5	0.0		0.696	0.0
Vacant		2.4	0.0		0.237	0.0
		Total kWh:	**6,033,772.9**		**Total Therms:**	**0.0**
Source:	EIA, CBECS, Table C 14			Source:	EIA, CBECS, Table C 24	

Table 3: Average Fuel Prices In Washington					
Fuel	2005	2008	2009	2010	Source
Natural Gas (therms)	$1.01	$1.12	$1.19	$1.02	EIA
Electricity (kwh)	$0.0713	$0.0682	$.0705	$0.0701	EIA
Gasoline (gallons)	$2.41	$3.45	$2.63	$3.06	EIA
Diesel (gallons)	$2.57	$3.87	$2.57	$3.12	EIA

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Fleet Energy Use #3

Agency: WDOC

CY: 2010

required	optional	non-entry

Table 4: Total Annual Fleet Energy Use and GHGs		Activity Data								Emissions					
Vehicle Class	Fleet	Fuel Use (gal)	Biomass %	Number of Vehicles	AC Units (#)	Miles	Hours of Operation	Notes	Average Miles per Gallon	Total Emissions (MT CO2e)	Fossil CO2 (MT CO2e)	CH4 (MT CO2e)	N2O (CO2e)	HFCs (CO2e)	Biomass CO2 (MT CO2e)
Light Duty On-Road Motor Vehicles (cars, SUVs, pick-up trucks, vans, motorcycles, etc.)	**Gasoline:**														
	GA Short Term Motor Pool:		7%							0	0	0.0	0.0	0.0	0
	GA Permanent Motor Pool:		7%							0	0	0.0	0.0	0.0	0
	Agency Owned:	692705.89	7%							5,678	5,656	5.6	16.5	0.0	279
	Ethanol:		85%							0	0	0.0	0.0	0.0	0
	Diesel:	224,098	0%							2,296	2,288	2.1	6.1	0.0	0
	Biodiesel:	8,714	20%							71	71	0.1	0.2	0.0	16
	Bulk Fuel:									0					
	Gasoline/Ethanol:		7%							0	0	0.0	0.0	0.0	0
	Diesel/Biodiesel:		9.9%							0	0	0.0	0.0	0.0	0
	Compressed Natural Gas (CNG):		0%							0	0	0.0	0.0	0.0	0
	Liquefied Petroleum Gas (LPG):		0%							0	0	0.0	0.0	0.0	0
	Propane:		0%							0	0	0.0	0.0	0.0	0
	Butanol:		0%							0	0	0.0	0.0	0.0	0
	Plug-in Electric:									0	0	0.0	0.0	0.0	0
	Total:	925,518		0	0	0				8,046	8,015	8	23	0	295
Heavy Duty On-Road Motor Vehicles (buses, heavy duty trucks, semi-trucks, dump trucks, snow plows, fire engines, etc.)	**Gasoline:**		7%							0	0	0.0	0.0	0.0	0
	Ethanol:		85%							0	0	0.0	0.0	0.0	0
	Diesel:		0%							0	0	0.0	0.0	0.0	0
	Biodiesel:		20%							0	0	0.0	0.0	0.0	0
	Bulk Fuel:														
	Gasoline/Ethanol:		7%							0	0	0.0	0.0	0.0	0
	Diesel/Biodiesel:		9.9%							0	0	0.0	0.0	0.0	0
	Compressed Natural Gas (CNG):		0%							0	0	0.0	0.0	0.0	0
	Liquefied Petroleum Gas (LPG):		0%							0	0	0.0	0.0	0.0	0
	Propane:		0%							0	0	0.0	0.0	0.0	0
	Butanol:		0%							0	0	0.0	0.0	0.0	0
	Total:	0		0	0	0	0			0	0	0.0	0.0	0.0	0

Vehicle Class	Fleet	Activity Data								Emissions					
		Fuel Use (gal)	Biomass %	Number of Vehicles	AC Units (#)	Miles	Hours of Operation	Notes	Average Gallons per Hour	Total Emissions (MT CO2e)	Fossil CO2 (MT CO2e)	CH4 (MT CO2e)	N2O (CO2e)	HFCs (CO2e)	Biomass CO2 (MT CO2e)
Off-Road Motor Vehicles (yellow iron, tractors, ATVs, forklifts, etc.)	**Gasoline:**		7%							0	0	0.0	0.0	0.0	0
	Ethanol:		85%							0	0	0.0	0.0	0.0	0
	Diesel:		0%							0	0	0.0	0.0	0.0	0
	Biodiesel:		20%							0	0	0.0	0.0	0.0	0
	Bulk Fuel:									0					
	Gasoline/Ethanol:		7%							0	0	0.0	0.0	0.0	0
	Diesel/Biodiesel:		9.9%							0	0	0.0	0.0	0.0	0
	Compressed Natural Gas (CNG):		0%							0	0	0.0	0.0	0.0	0
	Liquefied Petroleum Gas (LPG):		0%							0	0	0.0	0.0	0.0	0
	Propane:		0%							0	0	0.0	0.0	0.0	0
	Total:	0		0	0	0	0			0	0	0	0	0	0
Ferries	**Diesel:**		0%							0	0	0.0	0.0	0.0	0
	Biodiesel:		20%							0	0	0.0	0.0	0.0	0
	Electricity - Shorepower (kwh)		0%							0	0	0.0	0.0	0.0	0
	Total:	0		0	0	0	0			0	0	0	0	0	0
Boats	**Gasoline:**		7%							0	0	0.0	0.0	0.0	0
	Ethanol:		85%							0	0	0.0	0.0	0.0	0
	Diesel:		0%							0	0	0.0	0.0	0.0	0
	Biodiesel:		20%							0	0	0.0	0.0	0.0	0
	Bulk Fuel:														
	Gasoline/Ethanol:		7%							0	0	0.0	0.0	0.0	0
	Diesel/Biodiesel:		9.9%							0	0	0.0	0.0	0.0	0
	Total:	0		0	0	0	0			0	0	0.0	0.0	0.0	0
Aircraf	**Aviation Gasoline:**		0%							0	0	0.0	0.0	0.0	0
	Jet Fuel:		0%							0	0	0.0	0.0	0.0	0
	Total:	0		0	0	0	0			0	0	0.0	0.0	0.0	0
	Total:	925,518		0	0	0	0			8,046	8,015	7.7	22.8	0.0	295

Table 5: Total Fuel Used in All Vehicle Classes and Types (in gallons unless noted)	
Gasoline (gallons)	692,706
Ethanol (E100)	0
Diesel	231,069
Biodiesel (B100)	1,743
CNG (gge)	0
LPG	0
Propane	0
Butanol	0
Plug In Electric (kwh)	0
Aviation Gasoline	0
Jet Fuel	0

Table 6:	
Total # Vehicles	Total Miles Traveled
0	0

Table 7: Average Fuel Economy (Miles per Gallon) for Light Duty Vehicles				
2005	2008	2009	2010	Source
19.9	21.0	22.4	22.5	EPA

Table 8: Average Fuel Prices in Washington					
Fuel	2005	2008	2009	2010	Source
Gasoline (gallons)	$2.41	$3.45	$2.63	$3.06	EIA
Diesel (gallons)	$2.57	$3.87	$2.57	$3.12	EIA

Washington State Agency Greenhouse Gas Calculator

Employee Business Travel & Commuting Emissions Worksheet #4 (OPTIONAL FOR 2005 AND 2008)

Agency WDOC

CY: 2010

required	optional	non-entry

INSTRUCTIONS:

Step 1: In table 9, enter total miles traveled for business purposes in employee-owned personal vehicles. Calculate total miles traveled by dividing the total employee reimbursement in $ by the reimbursement rate. For 2010, the reimbursement rate was $0.50 per mile. Also enter miles traveled in short, medium, and long flights. See table 11 for air travel distances.

Step 2: If you can't quantify air miles traveled, enter the number of one way flights in table 11 to estimate the mileage. Then estimated mileage will automatically be entered into table 9. Or to estimate air miles traveled based on cost, divide the total airfare expenditures by $0.156 / passenger mile to get the passenger miles. Enter the passenger miles into table 9.

Step 3: Enter total GHG emissions from employee commuting (not including students or others) in Table 10. This information will come from the WSDOT CTR Reports. Only certain agencies with worksites in the 9 largest counties (Clark, Thurston, Pierce, King, Kitsap, Snohomish, Whatcom, Yakima and Spokane) with over 100 employees per worksite or co-located worksites participate in the CTR program. Starting in 2011 all worksites in Thurston County will start to participate in the CTR program. If data is available, Universities and community and technical colleges can report on emissions from student commuting separately by entering this into the comments section in the first tab of the workbook called Contents and Notes.
The CTR reports come out every two years. The most recent report came out in the spring of 2010 and included annual greenhouse gas emissions (MT CO2e) for roundtrip commute for 2009-2010. Enter the annual GHG emissions in MT CO2e for roundtrip commute for total employment. Please note, if you have multiple worksites that participate in CTR, you will need to add the GHG emissions from each worksite. Or contact Kathy Leotta at WSDOT (leottak@wsdot.wa.gov) for a report on the total GHG emissions from all worksites in CTR.
Currently we do not have a tool available for agencies that do not participate in the CTR program - these agencies can leave this blank.

Table 9: Total Miles Traveled and GHG Emissions from Employee Business Travel		Activity Data		GHG Emissions					
		Miles Traveled	Estimated Miles Traveled (from table 12 below)	Total Emissions (MT CO2e)	Fossil MT CO2 (CO2e)	MT CH4 (CO2e)	MT N2O (CO2e)	MT HFCs (CO2e)	Biomass MT CO2 (CO2e)
EMPLOYEE BUSINESS TRAVEL	Employee-Owned Vehicle Business Travel	288,317		121.1	114.8	0.1	0.3	5.8	5.7
	Air Travel:								
	SHORT FLIGHTS (0-300 MILES)			0.0	0.0	0.0	0.0	0.0	0.0
	MEDIUM FLIGHTS (300-700 miles)			0.0	0.0	0.0	0.0	0.0	0.0
	LONG FLIGHTS (>700 miles)			0.0	0.0	0.0	0.0	0.0	0.0
			Total GHGs:	121.1	114.8	0.1	0.3	5.8	5.7

Table 10: GHG Emissions from Employee Commuting			
EMPLOYEE COMMUTING	Total GHG Emissions for Roundtrip Commute for drive alone, carpools and vanpools		From CTR report for CTR worksites
	Drive alone rate (%)		

Table 11: Air Travel Distances (one-way distances from Seatac Airport)		
Boston	2490	miles
Chicago	1710	miles
Las Vegas	866	miles
Los Angeles	954	miles
Minneapolis/St. Paul	1390	miles
New York, N.Y.	2410	miles
Phoenix	1110	miles
Portland, Oregon	129	miles
Salt Lake City	687	miles
San Diego	1050	miles
San Francisco/Oakland	679	miles
Spokane	222	miles
Vancouver, B.C.	127	miles
Washington, D.C. / Baltimore	2300	miles

Mileage - Other Destinations: http://www.webflyer.com/travel/milemarker/

Table 12: Estimated Mileage for Short, Medium, and Long Flights				
One way flight distance	Example of destinations	# Of One-Way Flights	Average Mileage per flight	Total Miles
Short Flights (0-300 Miles)	All in-state flights, Vancouver, Portland		150	0
Medium Flights (300-700 Miles)	Idaho, Western Montana, Southern and Western Oregon, Northern California		500	0
Long Flights (Over 700 Miles)	Southern California, Southern U.S., Midwest, East Coast		2000	0

Washington State Agency Greenhouse Gas Calculator

Greenhouse Gas Emissions Summary #5

Agency WDOC

CY: 2010

Table 13: Total Annual Agency GHG Emissions	Percent of Total Emissions	Total Emissions MT CO2e	Fossil MT CO2 (CO2e)	MT CH4 (CO2e)	MT N2O (CO2e)	MT HFCs (CO2e)	Biomass MT CO2 (CO2e)**
BUILDING ENERGY USE							
Stationary Combustion	44.0%	46,467.6	46,220.5	25.3	221.8	N/A	0.0
Purchased Electricity	48.3%	50,995.5	50,725.7	20.2	249.6	N/A	0.0
Purchased Steam	0.0%	0.0	0.0	0.0	0.0	N/A	0.0
TOTAL BUILDING ENERGY USE GHG EMISSIONS*	**92.3%**	**97,463.1**	**96,946.2**	**45.6**	**471.4**	**N/A**	**0.0**
FLEET ENERGY USE							
On-road light duty	7.6%	8,046.0	8,015.4	7.7	22.8	0.0	295.3
On-road heavy duty	0.0%	0.0	0.0	0.0	0.0	0.0	0.0
Off-road	0.0%	0.0	0.0	0.0	0.0	0.0	0.0
Ferry	0.0%	0.0	0.0	0.0	0.0	0.0	0.0
Boat	0.0%	0.0	0.0	0.0	0.0	0.0	0.0
Air	0.0%	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL FLEET GHG EMISSIONS	**7.6%**	**8,046.0**	**8,015.4**	**7.7**	**22.8**	**0.0**	**295.3**
EMPLOYEE BUSINESS TRAVEL AND COMMUTING							
Employee Business Travel	0.1%	121.1	114.8	0.1	0.3	5.8	5.7
Employee Commuting***	0.0%	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL BUSINESS TRAVEL AND COMMUTING EMISSIONS	**0.1%**	**121.1**	**114.8**	**0.1**	**0.3**	**5.8**	**5.7**
TOTAL EMISSIONS	**100%**	**105,630.2**	**105,076.5**	**53.4**	**494.5**	**5.8**	**300.9**

* Note this does not include energy use in buildings owned by General Administration.

**Biomass CO2 emissions are reported separately and are not included in the total emissions.

***Emissions from commuting are reported in CO2e. Emissions by gas are estimated for CO2, CH4, N2O, and biomass CO2.

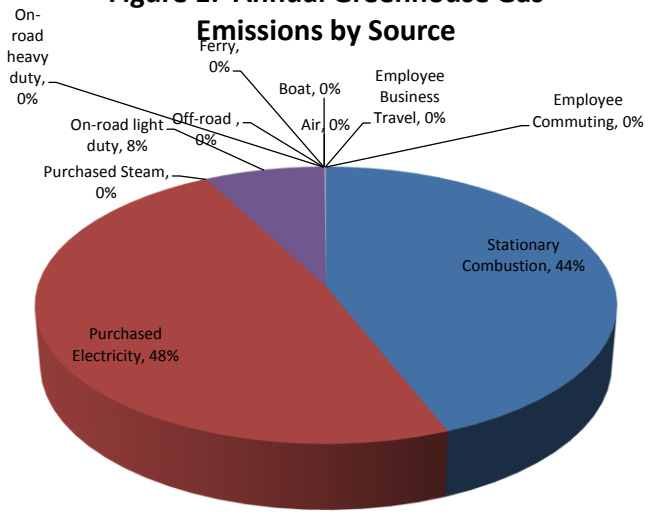
Table 14: GHG Emissions by Scope

Scope	Total (MT CO2e)	%
Scope 1 (Direct)	54,513.6	51.6%
Scope 2 (Indirect)	50,995.5	48.3%
Scope 3 (Other Indirect)	121.1	0.1%

Table 15: % of GHG Emissions by Source

Source of Greenhouse Gas Emissions	Percent of Greenhouse Gas Emissions
Stationary Combustion	44%
Purchased Electricity	48%
Purchased Steam	0%
On-road light duty	8%
On-road heavy duty	0%
Off-road	0%
Ferry	0%
Boat	0%
Air	0%
Employee Business Travel	0%
Employee Commuting	0%

Figure 1: Annual Greenhouse Gas Emissions by Source



Washington State Agency Greenhouse Gas Calculator

****OPTIONAL** Site/Facility Level Reporting for Building Energy Use Worksheet #6**

Agency: WDOC

CY: 2010

****Please note this worksheet is optional. Agencies may want to track data by facility or site for their internal use and can alter this sheet to fit their needs.**

				STATIONARY COMBUSTION										PURCHASED ENERGY			RENEWABLE ENERGY	
Site	Facility	Owned or Leased?	Primary Type of Space (office, retail, education, vacant, etc.)	FTEs	Sq. Ft.	Natural Gas (therms)	Natural Gas Purchases ($)	Fuel Oil (gallons)	Propane (Gallons)	Wood (short tons)	Diesel (used in fixed generators) (gallons)	Gasoline (used in fixed generators) (gallons)	Other fuel (used in fixed equipment) - list fuel & gallons	Electricity (kwh)	Electricity Purchases ($)	Steam (MMBtu)	Onsite Renewable Energy Generated (kwh)	Green Tags Purchased (kwh)
			TOTAL:	0	0	0	0	0	0	0	0	0		0	0	0	0	0

Washington State Agency Greenhouse Gas Calculator
Emissions Factors Worksheet #7 (For your reference only)

		Per Unit Energy, Mass or Volume						Emissions Per MMBtu						Conversion
Source	Fuel	CO2		CH4		N2O		CO2		CH4		N2O		
Stationary Sources	Natural gas	5.302	kg/therm	0.09	g/therm	0.09	g/therm	53.02	kg/MMB	0.9	g/MMBt	0.9	g/MMBt	1 therm=100,000 BTU
	Fuel Oil	10.21	kg/gallon	0.196	g/gallon	0.042	g/gallon	72.93	kg/MMB	1.4	g/MMBt	0.3	g/MMBt	0.14 MMBtu/gallon
	Diesel	10.15	kg/gallon	0.0966	g/gallon	0.0552	g/gallon	73.02	kg/MMB	0.7	g/MMBt	0.4	g/MMBt	0.138 MMBtu/gallon
	Biodiesel (100%)	9.45	kg/gallon	0.0896	g/gallon	0.0512	g/gallon	73.84	kg/MMB	0.7	g/MMBt	0.4	g/MMBt	0.128 MMBtu/gallon
	Gasoline	8.78	kg/gallon	0.0875	g/gallon	0.05	g/gallon	70.22	kg/MMB	0.7	g/MMBt	0.4	g/MMBt	0.125 MMBtu/gallon
	Ethanol (100%)	5.75	kg/gallon	0.0588	g/gallon	0.0336	g/gallon	68.44	kg/MMB	0.7	g/MMBt	0.4	g/MMBt	0.084 MMBtu/gallon
	Wood	1442.64	kg/short ton	143.03	g/short ton	90.74	g/short ton	93.8	kg/MMB	9.3	g/MMBt	5.9	g/MMBt	15.38 mmBtu/short ton
	Propane	5.59	kg/gallon	1.001	g/gallon	0.0546	g/gallon	61.46	kg/MMB	11	g/MMBt	0.6	g/MMBt	0.091 Mmbtu/gallon
	Aviation Gasoline	8.31	kg/gallon	1.32	g/gallon	0.072	g/gallon	69.25	kg/MMB	11	g/MMBt	0.6	g/MMBt	
	Jet Fuel	9.75	kg/gallon	1.485	g/gallon	0.081	g/gallon	72.22	kg/MMB	11	g/MMBt	0.6	g/MMBt	

Global Warming Potentials (GWP)	
(100 year time horizon)	
CO2	1
CH4	21
N2O	310
HFCs	140-11,700
PFCs	6,500-9,200
SF6	23,900
Source:	

IPCC, 1995, Second Assessment Report

Source: The Climate Registry (TCR), 2011, General Reporting Protocol, 2011 Default Emission Factors

		Per Unit Energy, Mass or Volume						Emissions Per MMBtu						Conversions
Source	Fuel	CO2		CH4		N2O		CO2		CH4		N2O		
Purchased Energy	Purchased Electricity	0.390	kg / kwh	7.41E-03	g / kwh	6.19E-03	g / kwh	114.168	kg/MMBtu	2.17227	g/MMBtu	1.81332	g/MMBtu	1 KWH = 3412 BTU
	Northwest regional power pool fuel	858.79	lbs CO2 / MWh	16.34	lbs CH4 / GWh	13.64	lbs N2O / GWh							
	Purchased Steam (Seattle Steam)	0.0886	MT CO2e/Mlb					0.0766	MT CO2e/M					

Source: EPA, eGrid 2010, Version 1.0, Year 2007 Summary Tables, NWPP emission factor
*Seattle Steam

		CO2						CH4											
Source	Fuel	Per Unit Volume		Per Unit Energy		Other		Light Duty Onroad		Heavy Duty Onroad		Onroad		Offroad		Boats		Ferries		Aircraft	
Fleet	Gasoline	8.78	kg CO2 / gal	70.22	kg CO2 / MMBTU			0.0172	g / mile	0.0326	g / mile	3.93E-04	kg CH4 / gal	0.5	g / gal	0.06	g / gal	0.06	g / gal	NA	
	Ethanol (E100)	5.75	kg CO2 / gal	68.46	kg CO2 / MMBTU			0.055	g / mile	0.197	g / mile	2.67E-04	kg CH4 / gal	NA		NA		NA		NA	
	Diesel	10.21	kg CO2 / gal	74	kg CO2 / MMBTU			0.001	g / mile	0.0051	g / mile	4.39E-04	kg CH4 / gal	0.58	g / gal	0.74	g / gal	0.74	g / gal	NA	
	Biodiesel (B100)	9.45	kg CO2 / gal	73.85	kg CO2 / MMBTU			0.0005	g / mile	0.005	g / mile	4.04E-04	kg CH4 / gal	NA		NA		NA		NA	
	CNG	6.84	kg CO2 / gge	53.06	kg CO2 / MMBTU	0.054	kg CO2/scf	0.737	g / mile	1.966	g / mile	1.23E-04	kg CH4 / gge	NA		NA		NA		NA	
	LPG	5.79	kg CO2 / gal	63.18	kg CO2 / MMBTU			0.037	g / mile	0.066	g / mile	9.66E-05	kg CH4 / gal	NA		NA		NA		NA	
	Propane	5.59	kg CO2 / gal	63.07	kg CO2 / MMBTU			NA		NA		9.60E-05	kg CH4 / gal	NA		NA		NA		NA	
	Butanol	6.58	kg CO2 / gal	64.97	kg CO2 / MMBTU			NA		NA		1.09E-04	kg CH4 / gal	NA		NA		NA		NA	
	Residual Fuel Oil (#5 & #6)	11.27	kg CO2 / gal	75.1	kg CO2 / MMBTU			NA		NA		NA		NA		0.11	g / gal	0.11	g / gal	NA	
	Aviation Gasoline	8.31	kg CO2 / gal	69.26	kg CO2 / MMBTU			NA		NA		NA		NA		NA		NA		7.05	g / gal
	Jet fuel	9.75	kg CO2 / gal	72.23	kg CO2 / MMBTU			NA		NA		NA		NA		NA		NA		0.27	g / gal

Source: The Climate Registry (TCR), 2011, General Reporting Protocol, 2011 Default Emission Factors
*IPCC, 2006, Guidelines for National GHG Inventories Vol 2 Table 2.2

N2O												
Light Duty Onroad		Heavy Duty Onroad		Onroad		Offroad		Boats		Ferries		Aircraft	
0.0038	g / mile	0.0177	g / mile	7.86E-05	kg N2O / gal	0.22	g / gal	0.39	g / gal	0.39	g / gal	NA	
0.067	g / mile	0.175	g / mile	5.33E-05	kg N2O / gal	NA		NA		NA		NA	
0.0015	g / mile	0.0048	g / mile	8.77E-05	kg N2O / gal	0.26	g / gal	0.26	g / gal	0.26	g / gal	NA	
0.001	g / mile	0.005	g / mile	8.07E-05	kg N2O / gal	NA		NA		NA		NA	
0.05	g / mile	0.175	g / mile	1.37E-05	kg N2O / gge	NA		NA		NA		NA	
0.067	g / mile	0.175	g / mile	9.66E-06	kg N2O / gal	NA		NA		NA		NA	
NA		NA		9.60E-06	kg N2O / gal	NA		NA		NA		NA	
NA		NA		1.09E-05	kg N2O / gal	NA		NA		NA		NA	
NA		NA		NA		NA		0.6	g / gal	0.6	g / gal	NA	
NA		NA		NA		NA		NA		NA		0.11	g / gal
NA		NA		NA		NA		NA		NA		0.31	g / gal

Source	Flight Length	CO2		CH4		N2O	
Air Travel	Short Flight (0-300 miles)	0.277	kg/ passsenger mile	0.0104	g/ passenger mile	0.0085	g/ passenger mile
	Medium Flight (300-700 miles)	0.229	kg/ passenger mile	0.0104	g/ passenger mile	0.0085	g/ passenger mile
	Long Flight (>700 miles)	0.185	kg/ passenger mile	0.0104	g/ passenger mile	0.0085	g/ passenger mile

Source: EPA, 2008, Climate Leaders Guidance, Optional Emissions from Commuting Business Travel and Product Transport

Washington State Agency Greenhouse Gas Calculator
Conversion Factors Worksheet #8

Mass			
1 pound (lb)	453.6 grams (g)	0.4536 kilograms (kg)	0.0004536 metric tons (tonne)
1 kilogram (kg)	2.205 pounds (lb)		
1 short ton (ton)	2,000 pounds (lb)	907.2 kilograms (kg)	
1 metric ton (tonne)	2,205 pounds (lb)	1,000 kilograms (kg)	1.102 short tons (tons)

Volume			
1 cubic foot (ft^3)	7.4805 US gallons (gal)	0.1781 barrel (bbl)	
1 cubic foot (ft^3)	28.32 liters (L)	0.02832 cubic meters (m^3)	
1 US gallon (gal)	0.0238 barrel (bbl)	3.785 liters (L)	0.003785 cubic meters (m^3)
1 barrel (bbl)	42 US gallons (gal)	158.99 liters (L)	0.1589 cubic meters (m^3)
1 liter (L)	0.001 cubic meters (m^3)	0.2642 US gallons (gal)	
1 cubic meter (m^3)	6.2897 barrels (bbl)	264.2 US gallons (gal)	1,000 liters (L)

Energy			
1 kilowatt hour (kWh)	3,412 Btu (Btu)	3,600 kilojoules (KJ)	
1 megajoule (MJ)	0.001 gigajoules (GJ)		
1 gigajoule (GJ)	0.9478 million Btu (mmBtu)	277.8 kilowatt hours (kWh)	
1 Btu (Btu)	1,055 joules (J)		
1 million Btu (mmBtu)	1.055 gigajoules (GJ)	293 kilowatt hours (kWh)	
1 therm (therm)	100,000 Btu (Btu)	0.1055 gigajoules (GJ)	29.3 kilowatt hours (kWh)
100 ft^3 of natural gas (scf)	1.03 therm (therm)	1,030 Btu (Btu)	

Other	
Kilo	1,000
Mega	1,000,000
Giga	1,000,000,000
Tera	1,000,000,000,000
Molecular Weigh of C	12
Molecular Weight of CO_2	44
1 metric ton of carbon	44/12 metric tons of CO2

For other energy conversions, use an online conversion tool such as: http://www.onlineconversion.com/energy.htm